SOUTH FLORIDA WATER MANAGEMENT DISTRICT

Kissimmee Basin Water Reservations

Lawrence Glenn, Kissimmee Director

August 12, 2009 Workshop Item #15

Part Two Update

July 2009

- Overview of Water Reservations
- Summary of Technical Analysis

August 2009

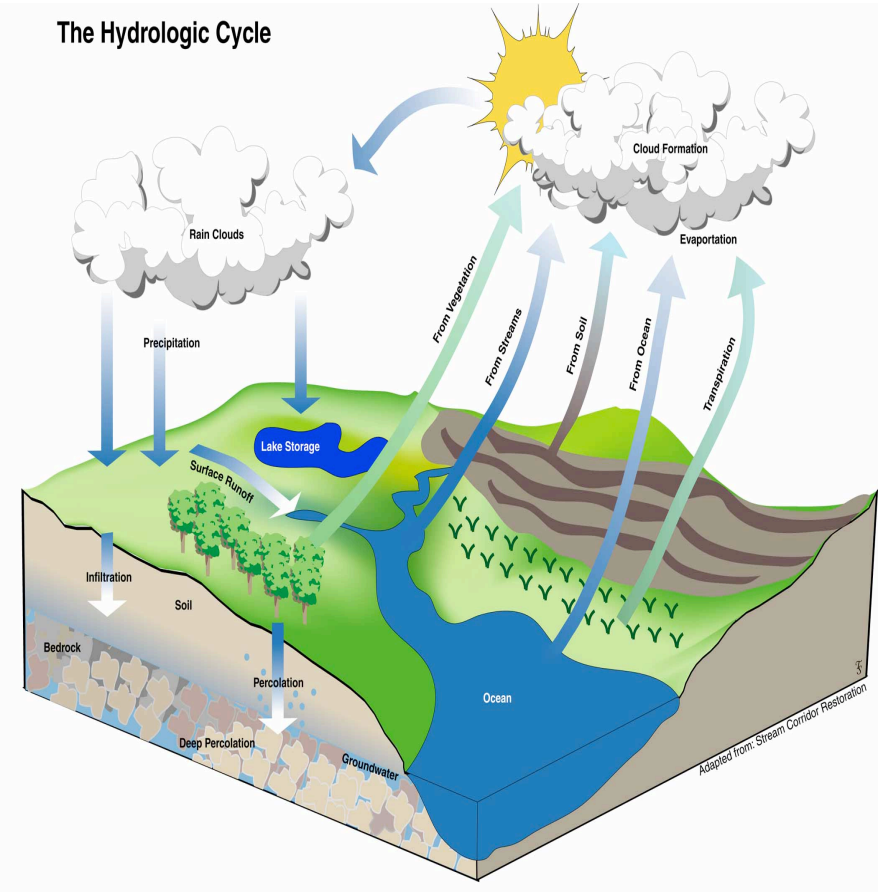
- Overview of Modeling Tools
- Identification of Key Water Sources

Modeling Tools being used for Kissimmee Basin Water Reservation

- Mike She/11
  - Integrates surface and ground water
  - Evaluates daily flows and stages (1965 thru 2005)
- Well-calibrated
- Peer reviewed
- Re-calibrated to incorporate peer review and staff recommendations
- Hydrologic and Environmental Systems Modeling technical lead on all model related work

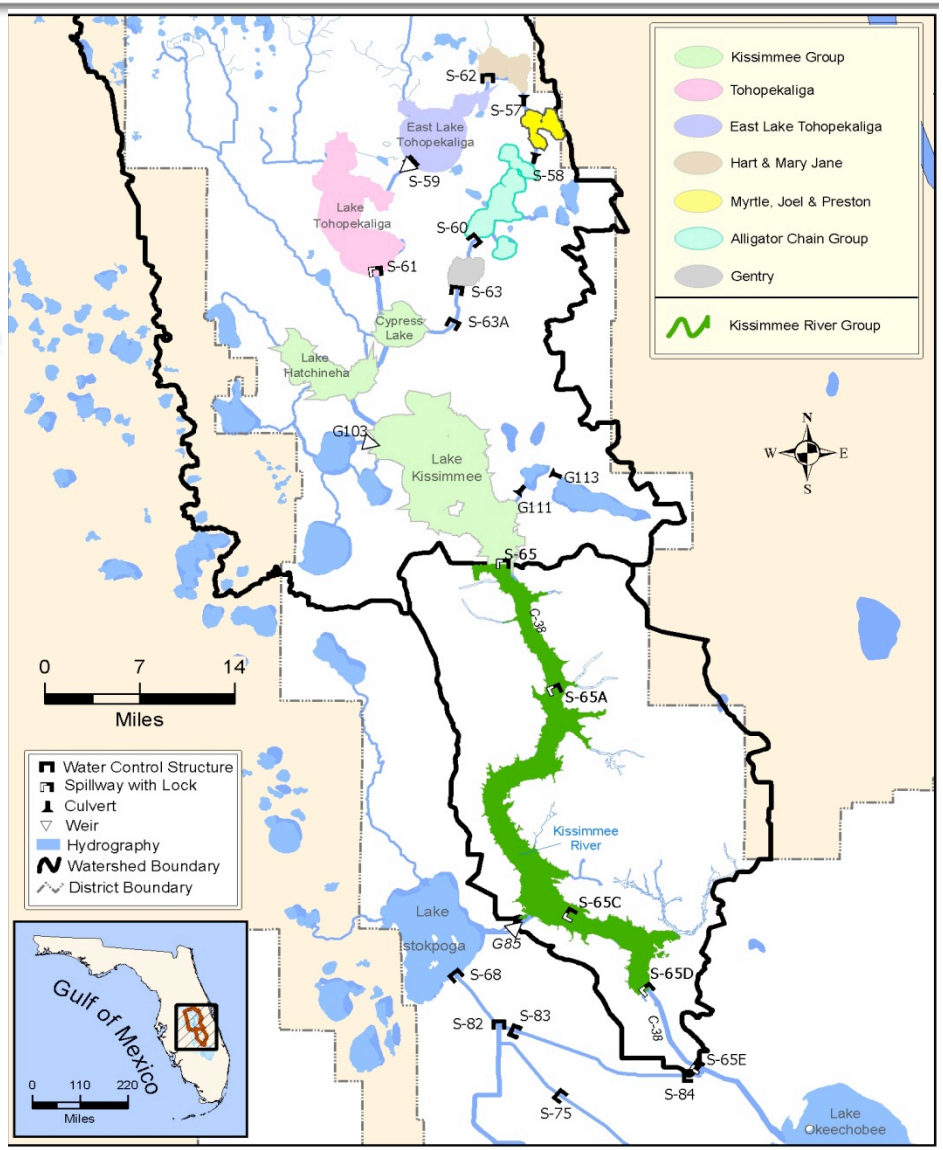
Model Assumptions

- Explicit modeling of coupled hydrology and hydraulics
- Explicit modeling of structure operations
- Groundwater simulated but not intended for groundwater permitting
- Focus is on surface hydrology including surficial aquifer system



Reservation Water Bodies: Kissimmee River and the Chain of Lakes

- 7 lake management areas (19 lakes)
- Restored Kissimmee River and floodplain (S-65 to S-65E)
  - 103 miles of River and floodplain
  - 27,000 acres wetland habitat



Base Condition Assumptions

- 41-Year period of simulation (1965 – 2005)
- Existing Land Use (2000)
  - Consistent with 2005 Kissimmee Basin Water Supply Planning Efforts
- Completed Kissimmee River Restoration Project
  - Headwater Revitalization Regulation Schedule (S-65)
  - Backfilled C-38 Canal
  - Recarved River Channel
  - Modified Upper and Lower Basin Infrastructure (including canal dredging and widening)
- Existing Permitted Surface Water and Groundwater Uses as of August 2008

2007 / 2008 Model Peer Review

- Model Peer Review (March 2007 – July 2008)
  - Daniel P. Loucks, Cornell University – Chair
  - David A. Chen, University of Miami
  - Robert H. Prucha, Integrated Hydro Systems, LLC
- Charge: Assess the quality and credibility of the science used to develop the AFET model and its applicability to decision-making for operational management of structures in the Kissimmee Basin

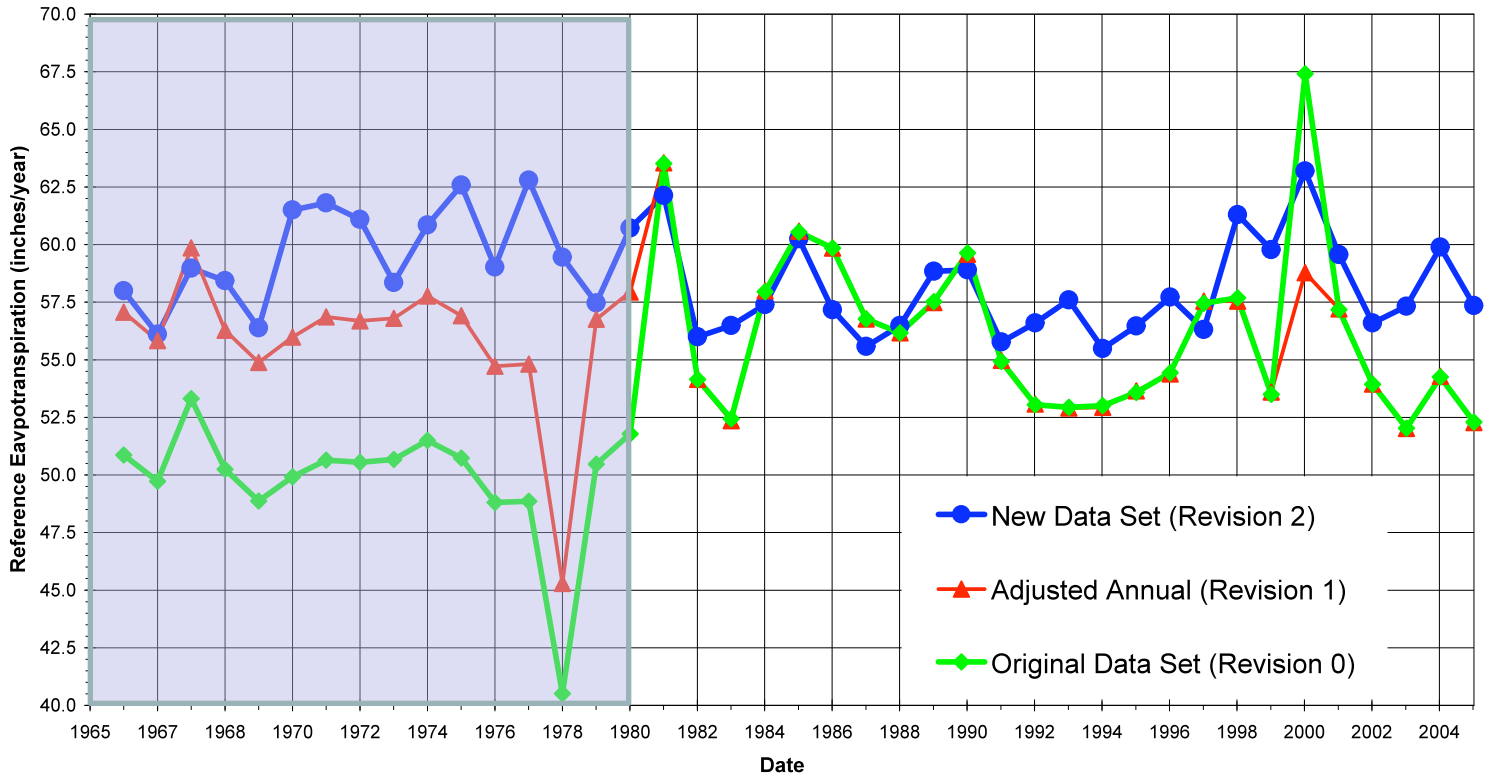
2007/08 Model Peer Review: Findings and Recommendations

- No critical defects in the model development completed as of this date
- No critical defects in the model development activities planned for the completion of this study
- MIKE 11 model robust in accounting for physical changes in the system, since it was calibrated under post-Phase I conditions (2001-2004) and validated under pre-Phase I conditions (1994-1998).
- Identified potential/reference evapotranspiration (P/RET) values were suspect
- Recommended P/RET values be revised

SFWMD Staff Concerns

- Cumulative runoff over the base condition simulation period (1965 – 2005) too high relative to S-65 observed flows
- Aquifer dynamics were not well characterized

Suspect potential/reference evapotranspiration (P/RET) values replaced



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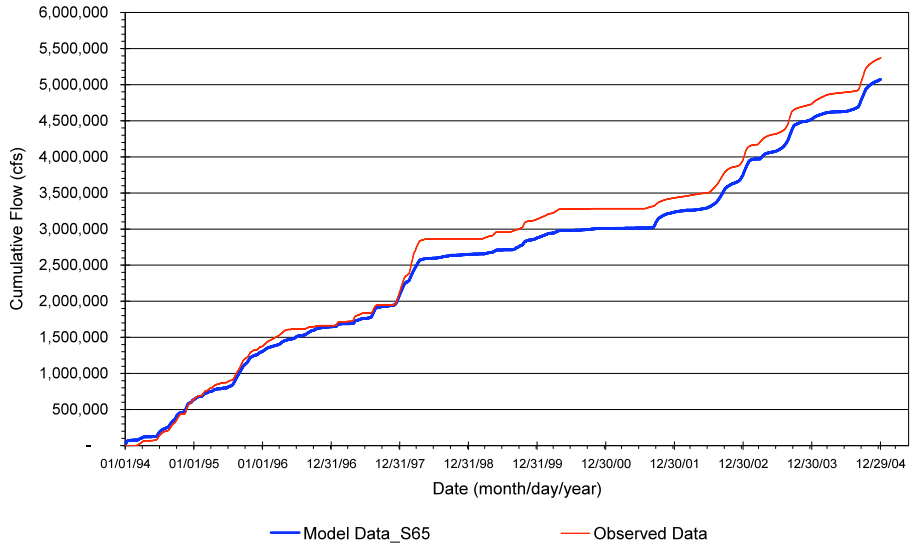
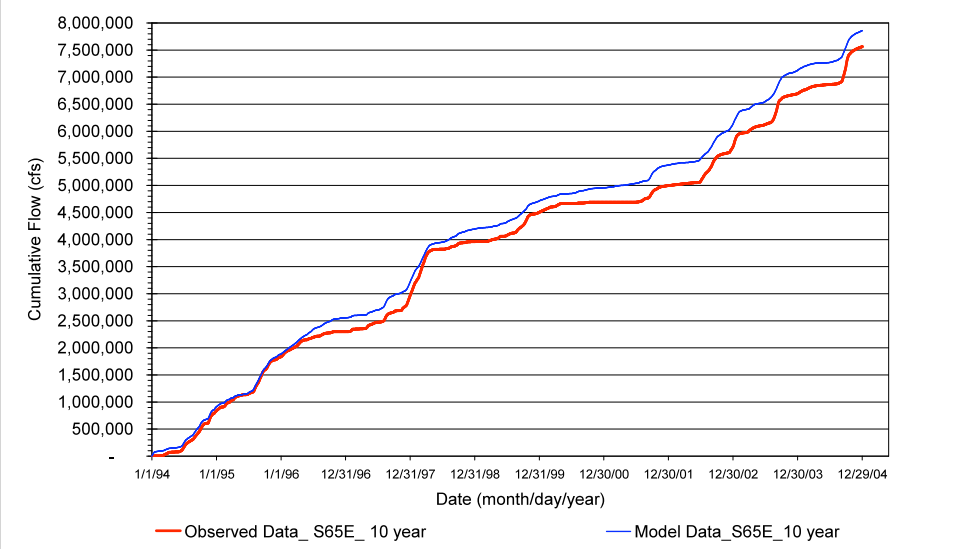
Model generated cumulative runoff reduced

10-year Cumulative Runoff (1994 – 2004): S-65, S-65E





Structure S65			
Run	Cumulative Modeled (cfs)	Cumulative Observed (cfs)*	Cumulative Error
Run 81 10 year run (94-04)	5,072,582.42	5,367,838.72	6%

* Uses the Preferred DBKEY HO289

Structure S65E			
Run	Cumulative Modeled (cfs)	Cumulative Observed (cfs)	Cumulative Error
Run 81 10 year run (94-04)	7,859,587.17	7,562,106.57	-4%

Aquifer dynamics in the surficial aquifer improved

Surficial Aquifer Groundwater Statistics for the Calibration Period

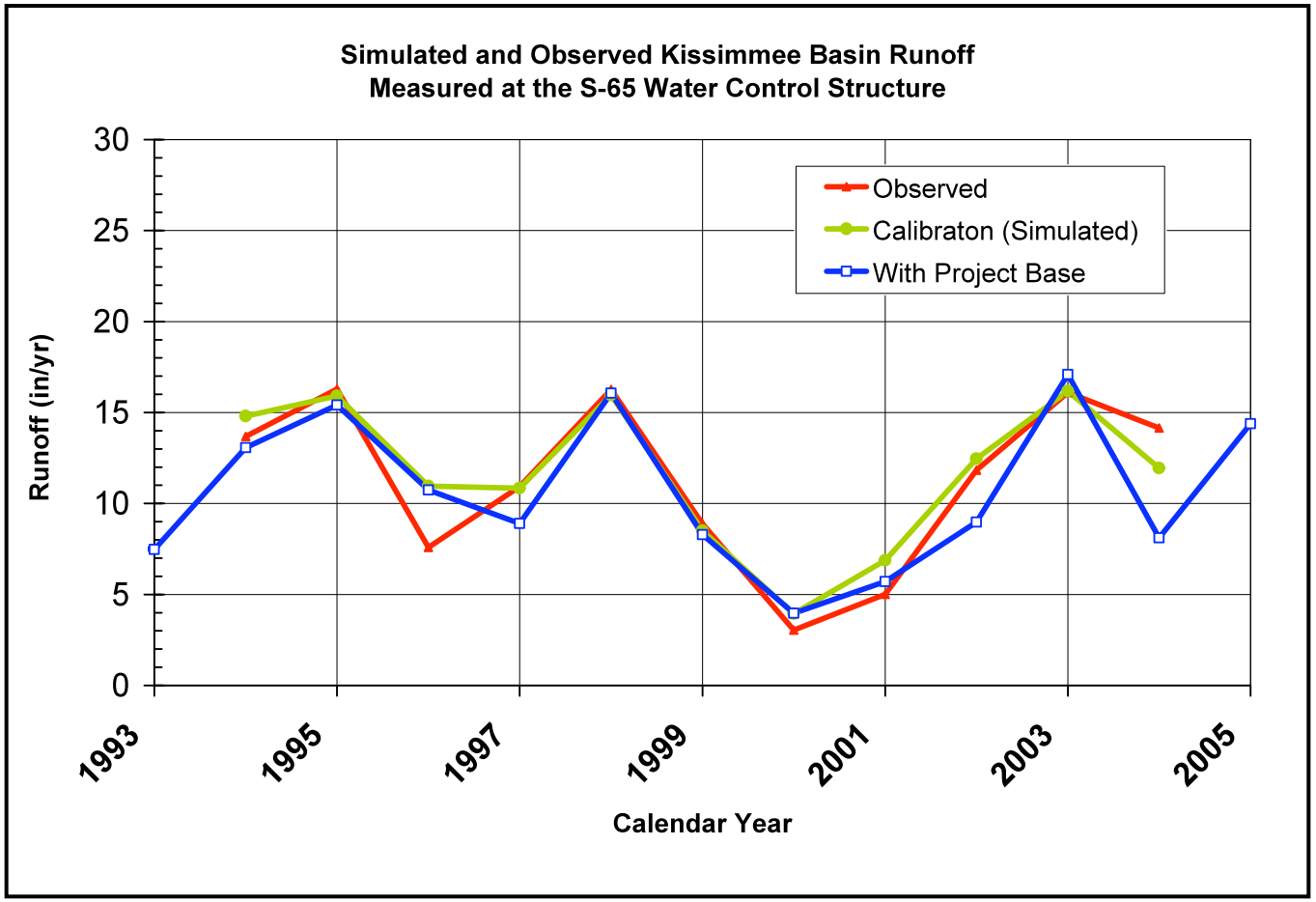
Calibration Statistics	Targets	Run 81
% of primary wells with Mean Error (ME) and Absolute Error (MAE) ≤ ± 2.5 feet	50%	61%
% of primary wells with Mean Error (ME) and Absolute Error (MAE) ≤ ± 5.0 feet	80%	91%
% of primary wells with Root Mean Squared Error (RMSE) ≤ ± 5.0 feet	80%	91%
Overall Mean Error	± 1.0	- 0.53

Aquifer dynamics in the Upper Floridan improved

Floridan Aquifer Groundwater Statistics for the Calibration Period

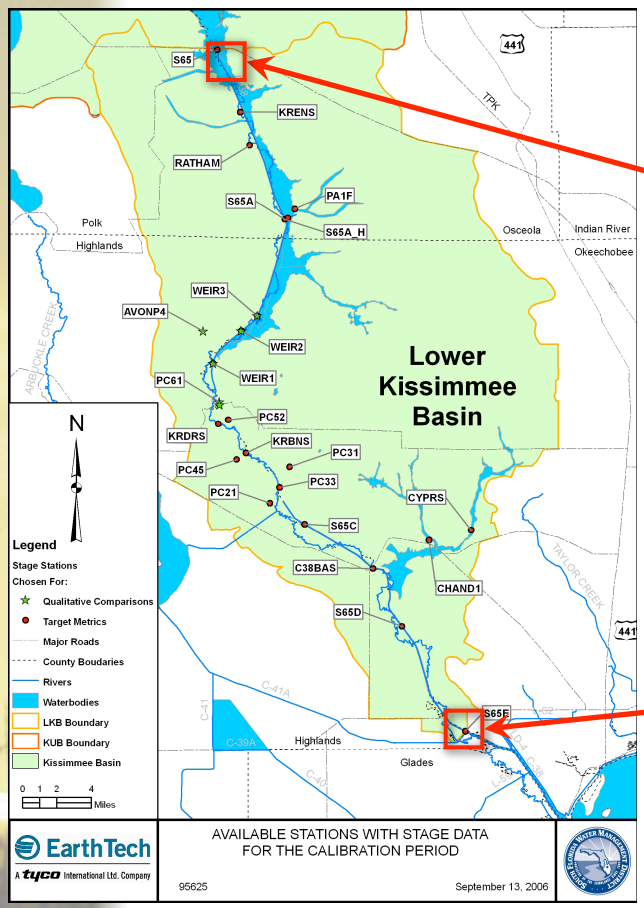
Calibration Statistics	Targets	Run 81
% of primary wells with Mean Error (ME) and Absolute Error (MAE) ≤ ± 2.5 feet	50%	90%
% of primary wells with Mean Error (ME) and Absolute Error (MAE) ≤ ± 5.0 feet	80%	90%
% of primary wells with Root Mean Squared Error (RMSE) ≤ ± 5.0 feet	80%	90%
Overall Mean Error	± 1.0	- 0.96

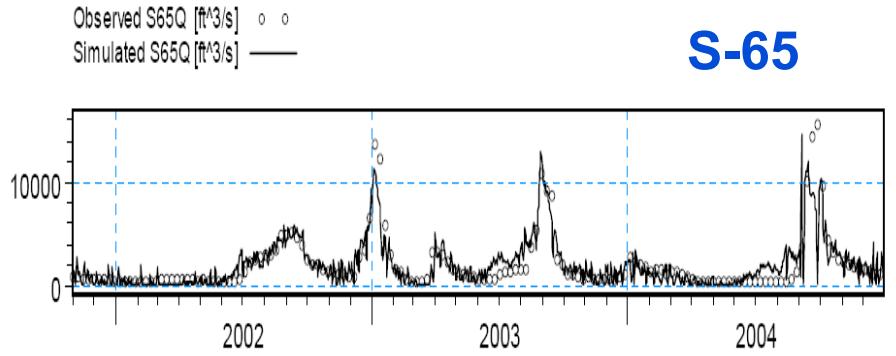
Model Calibration Results (S-65: 1994 – 2004):
Good match in runoff at S-65 for base conditions, calibration results, and observed data

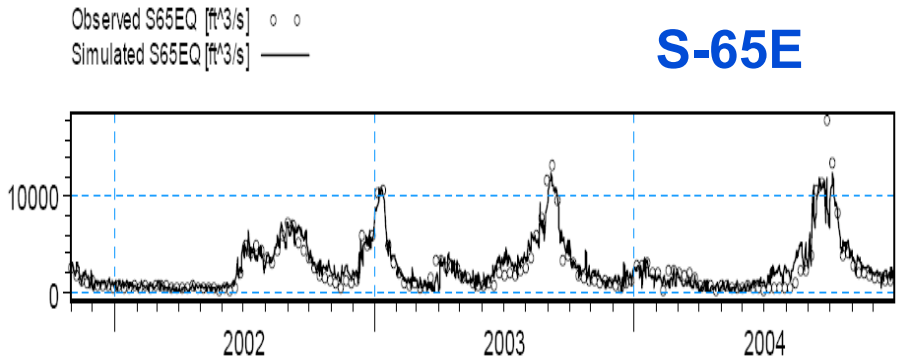


Model Calibration Results (2001 – 2004):

Simulation results closely match observed conditions at S-65 and S-65E (includes 2004 Hurricane Season)



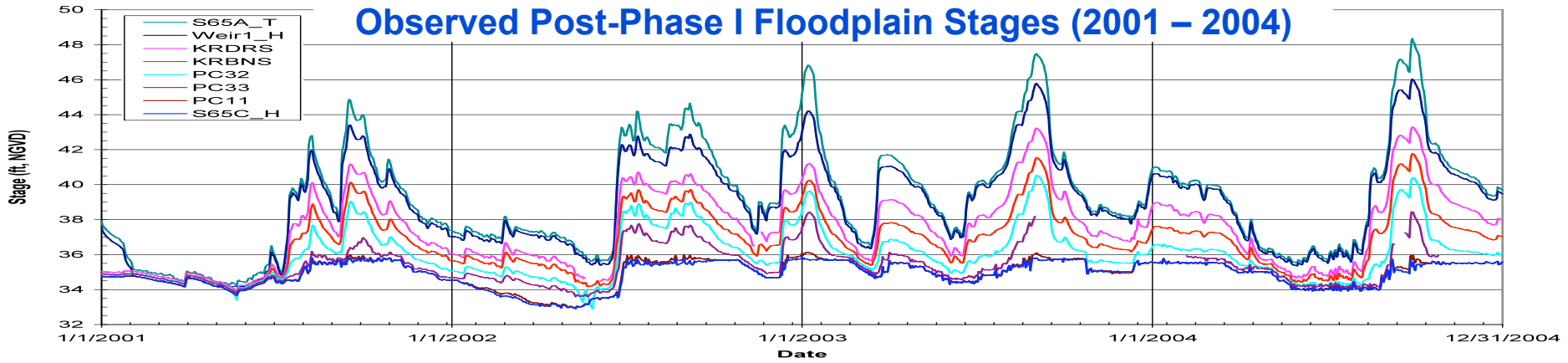




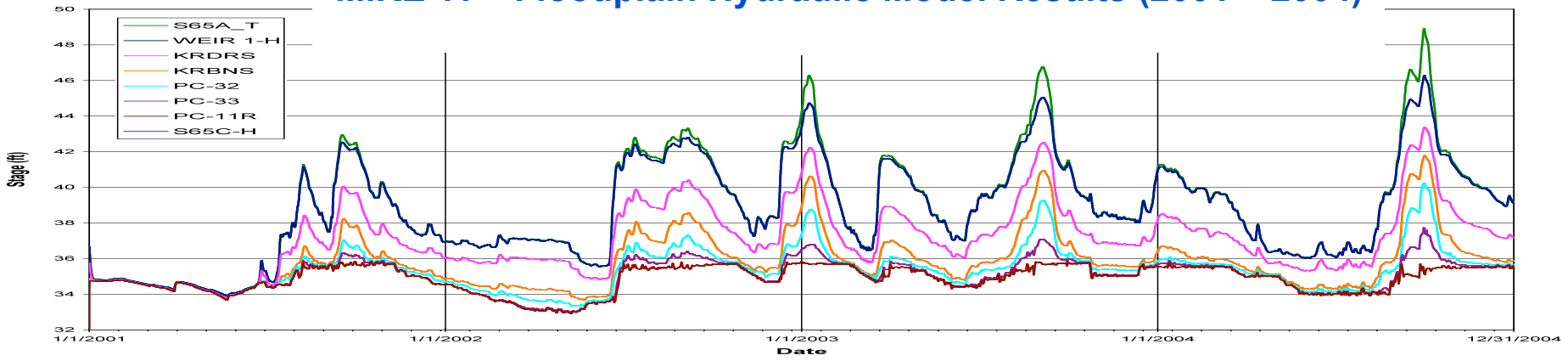
Model Calibration Results (2001 – 2004):

Simulation results closely match observed conditions in the Post-Phase I Floodplain (includes 2004 Hurricane Season)

Observed Post-Phase I Floodplain Stages (2001 – 2004)

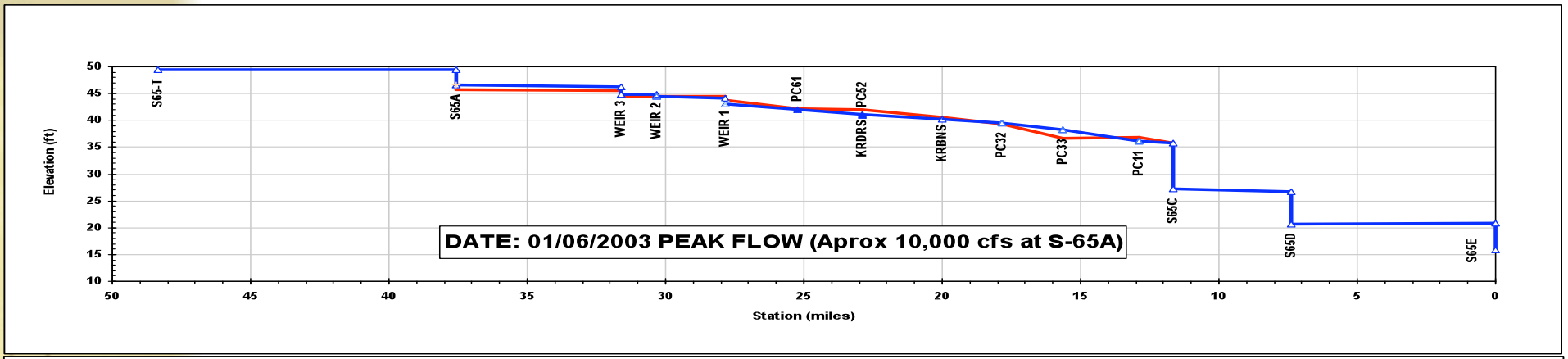


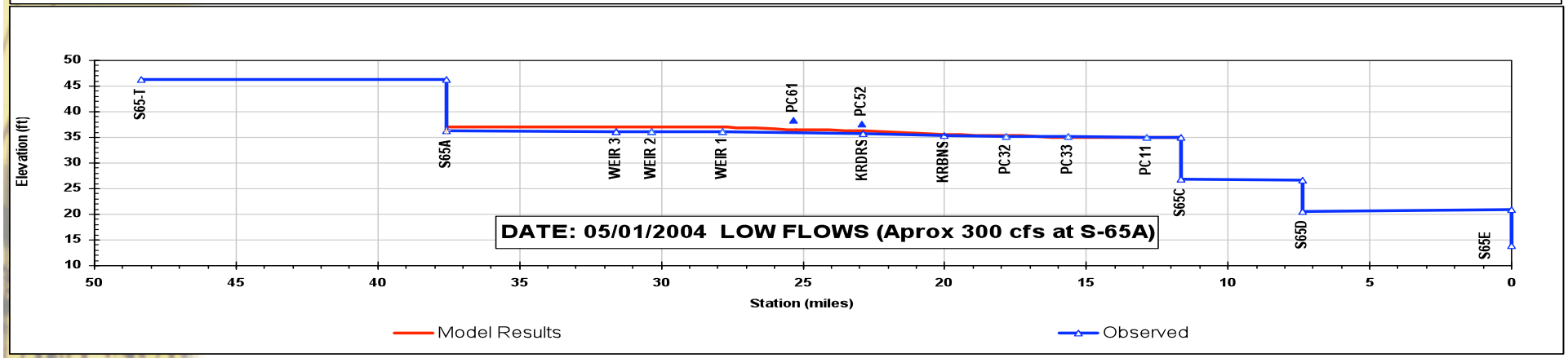
MIKE 11 – Floodplain Hydraulic Model Results (2001 – 2004)



Hydraulic Model Calibration Results for River / Floodplain (2001 – 2004)

Model matches hydraulic gradients in the restored portion of the river under high and low flow conditions (10,000 and 300 cfs)

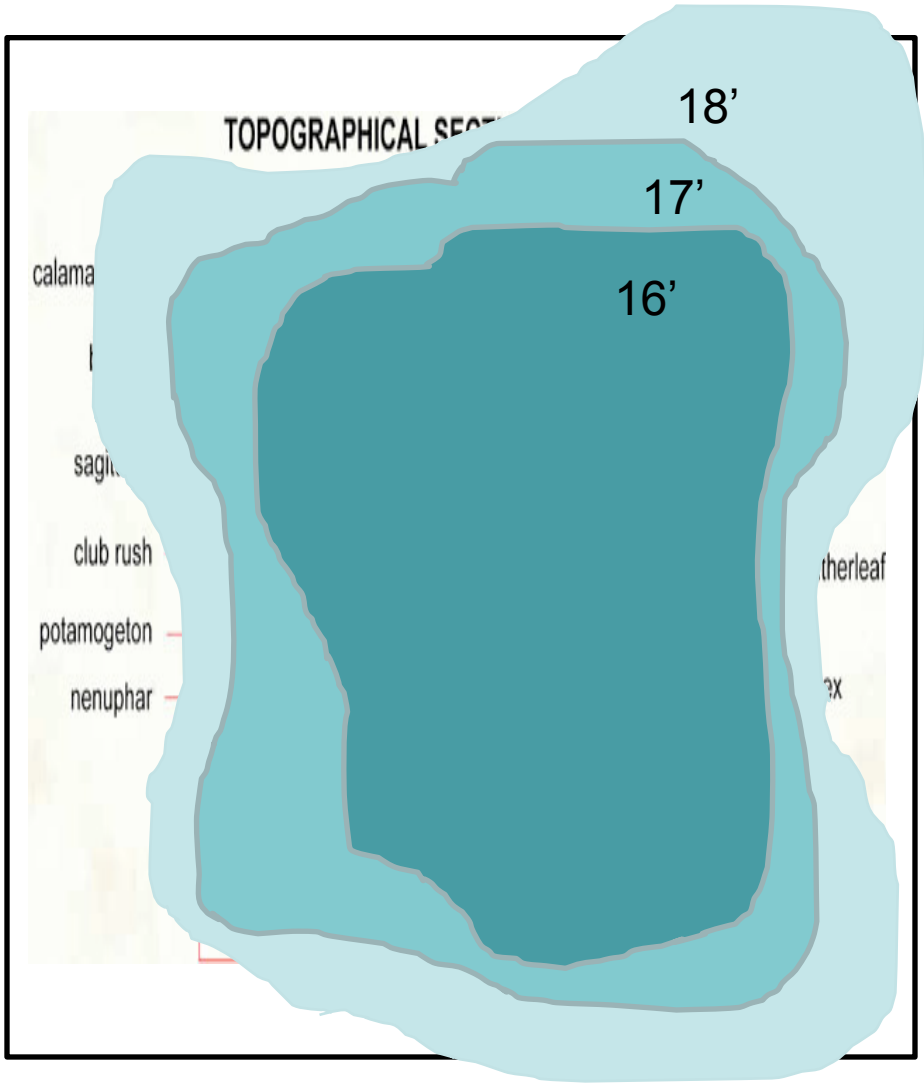




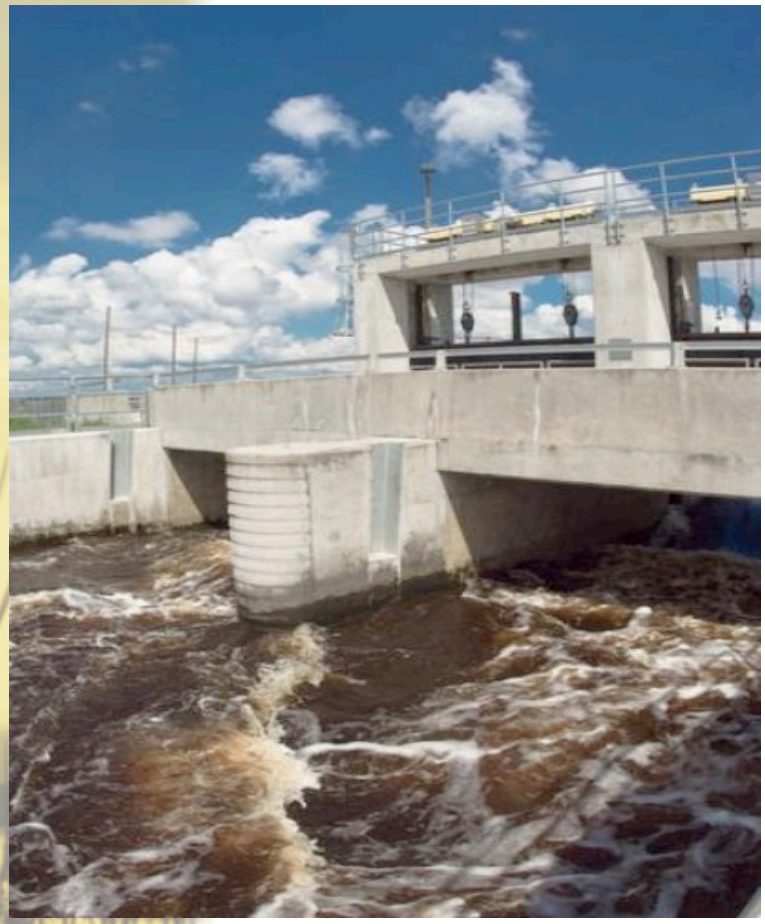
Model Summary – Reasons it works well

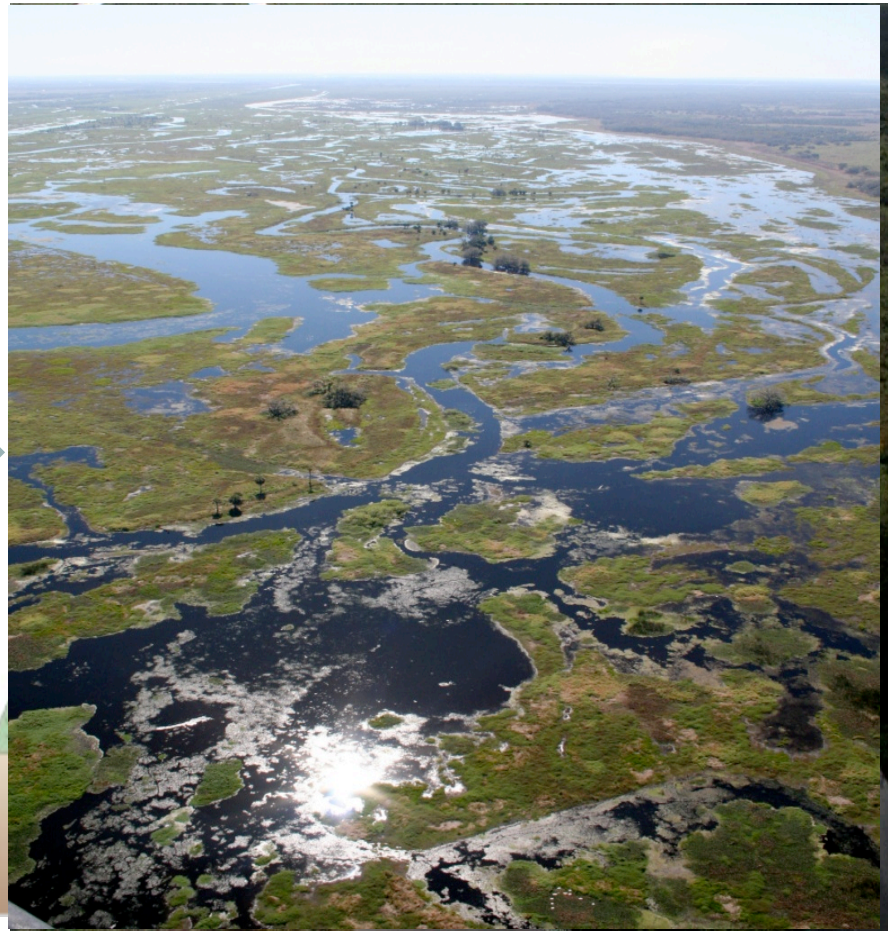
- Quality of Long-term Stage and Flow Data
  - Extensive evaluation of data for Period of Record
  - Best data used for calibration/verification
- Quality of Topographic Data
  - Excellent Simulation of Floodplain Hydraulics
- Limited Turn-over in Model Development Team
- Excellent fit for Water Reservations Development
  - Water Reservations based on “Stages and Flows”

Significance of Lake Stage



Significance of Flow





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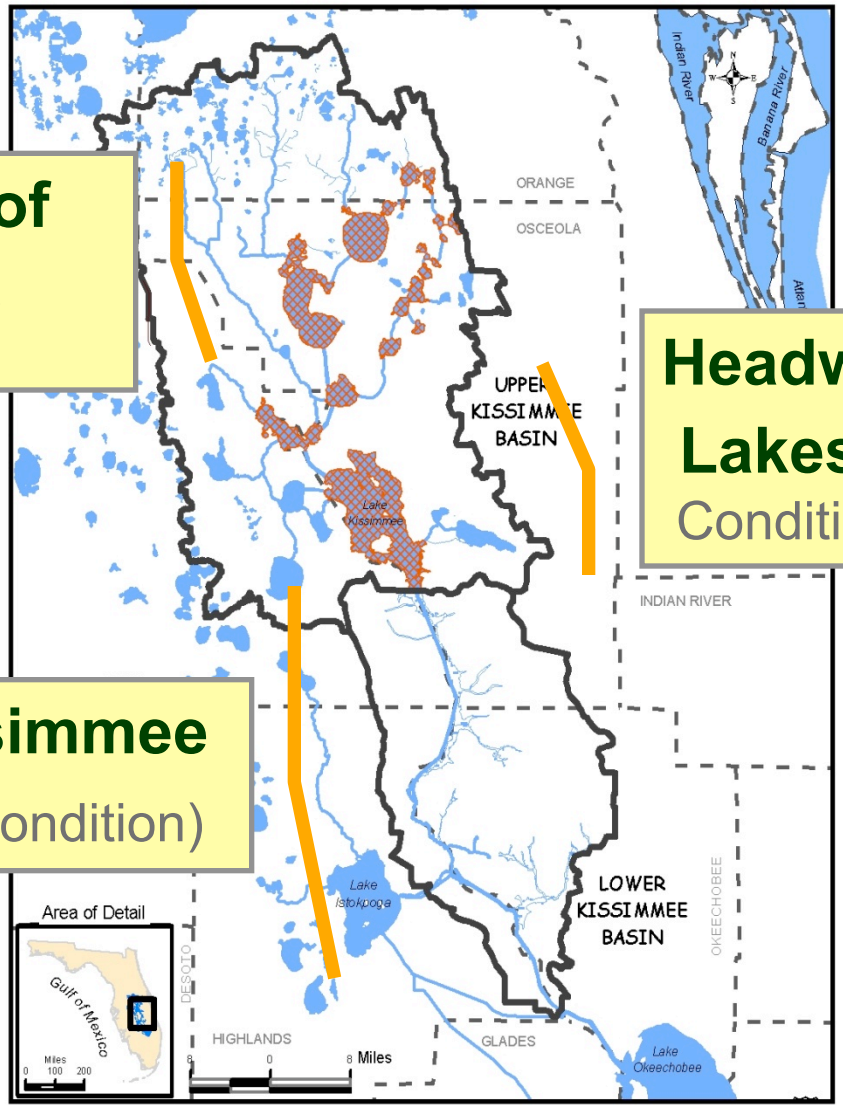
Foundational Assumptions of the Kissimmee Basin Water Reservations

Upper Chain of Lakes (Current Condition)

Headwaters Lakes (Future Condition)

Restored Kissimmee River (Future Condition)



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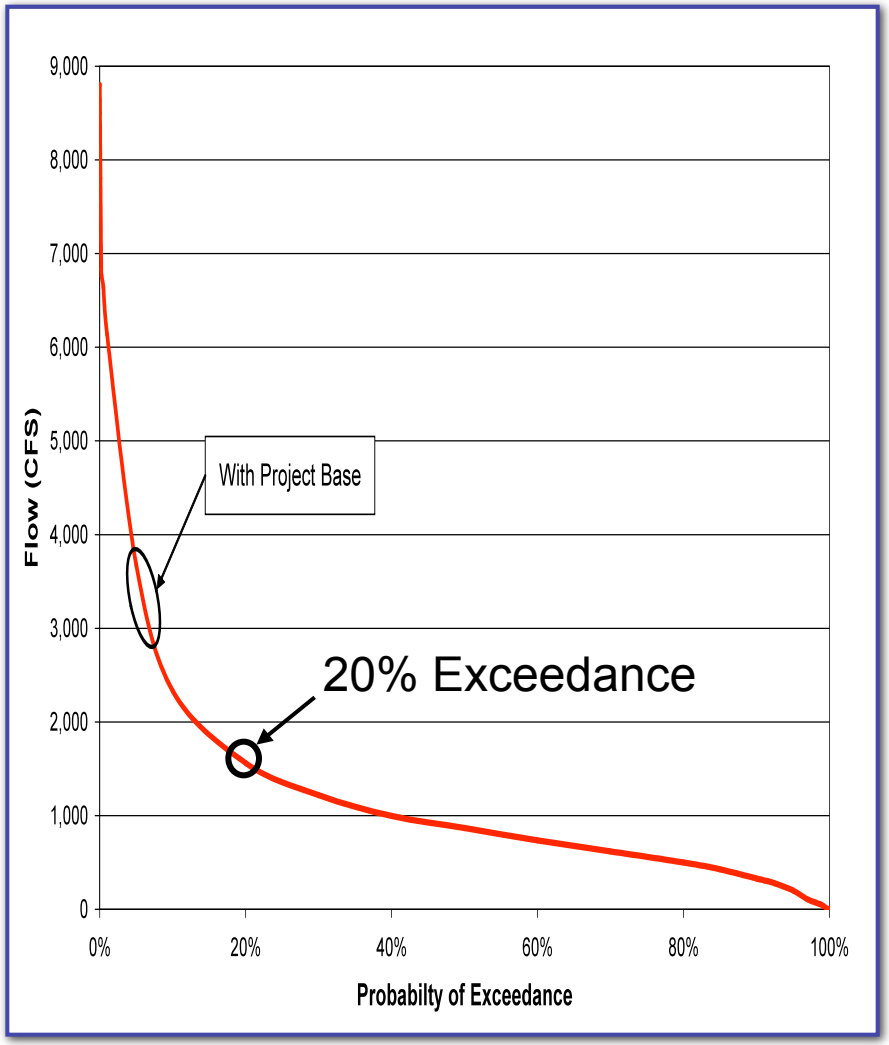
With-Project Base Condition

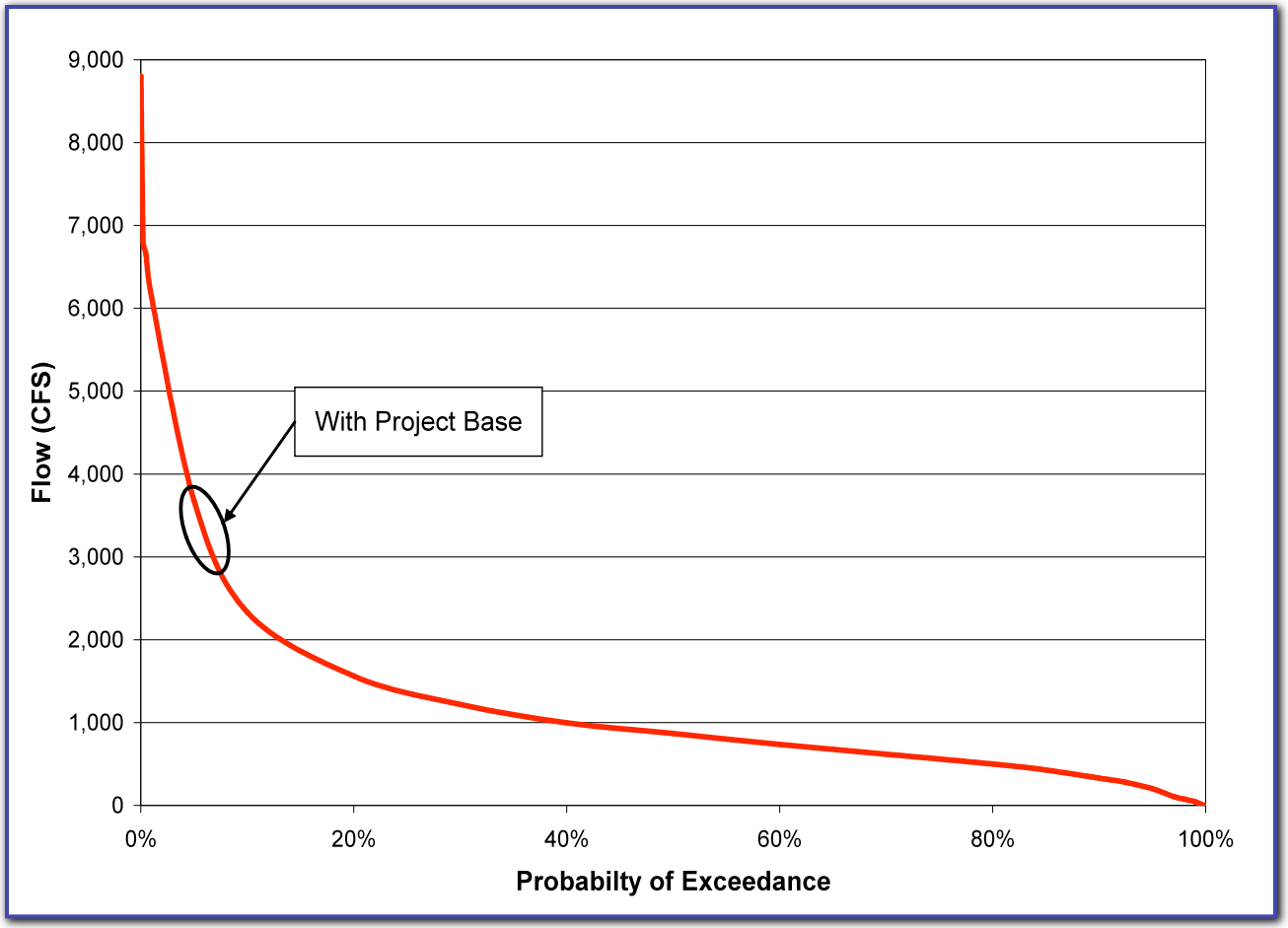
- 41-Year period of simulation (1965 – 2005)
- Existing Land Use (2000)
- HESM / IMC Reference Evapotranspiration
- Completed Kissimmee River Restoration Project
- Existing Permitted Surface Water and Groundwater Uses as of August 2008

Duration Curve Background

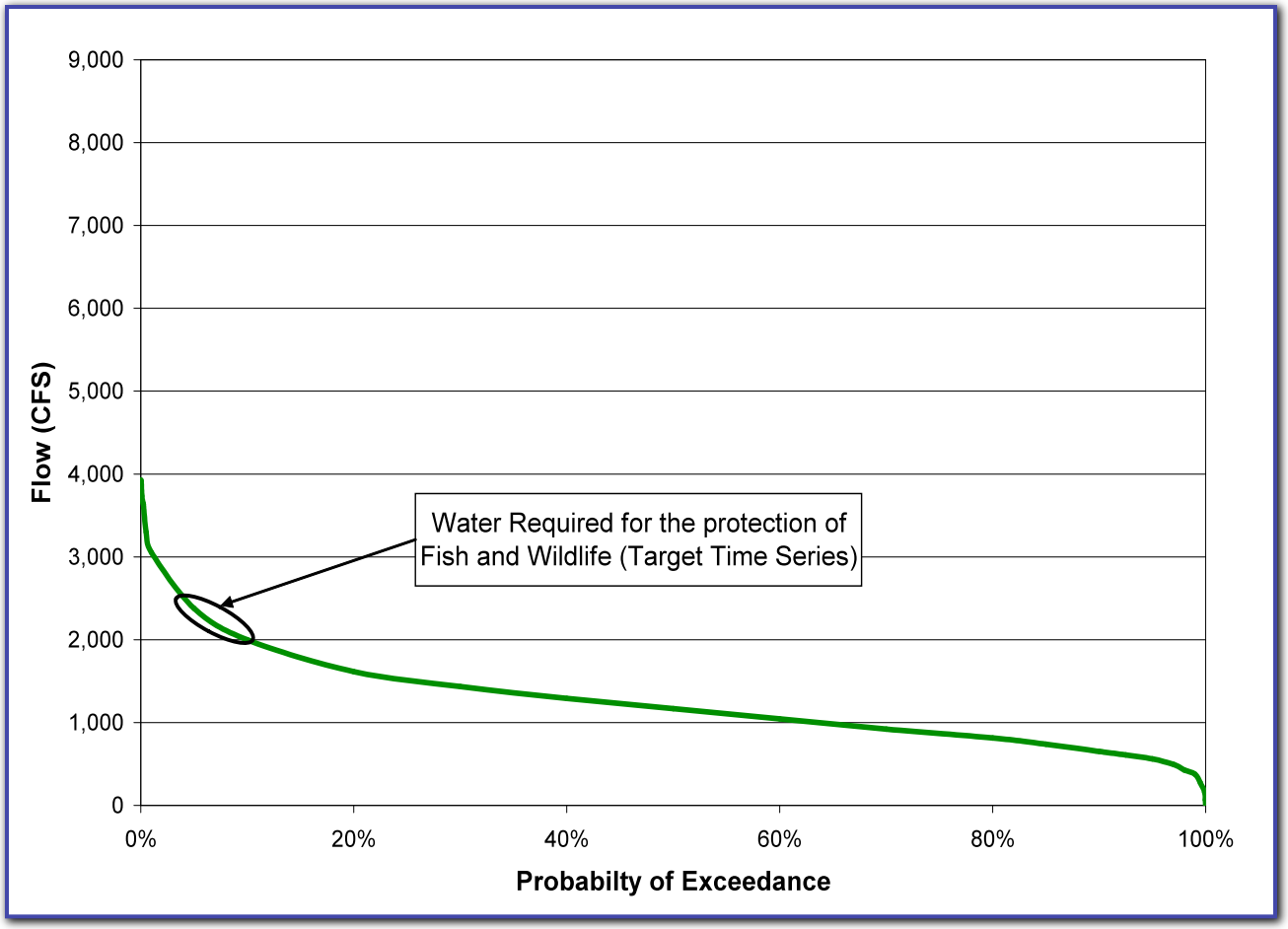
- Development:
  - Daily data for Period of Record (1965-2005)
  - For this analysis, there are 14,975 daily values, or occurrences
  - 20% represented approximately 3,000 occurrences
- Application:
  - When a value has a 20% exceedance, 3,000 of the occurrences are greater than the stated value



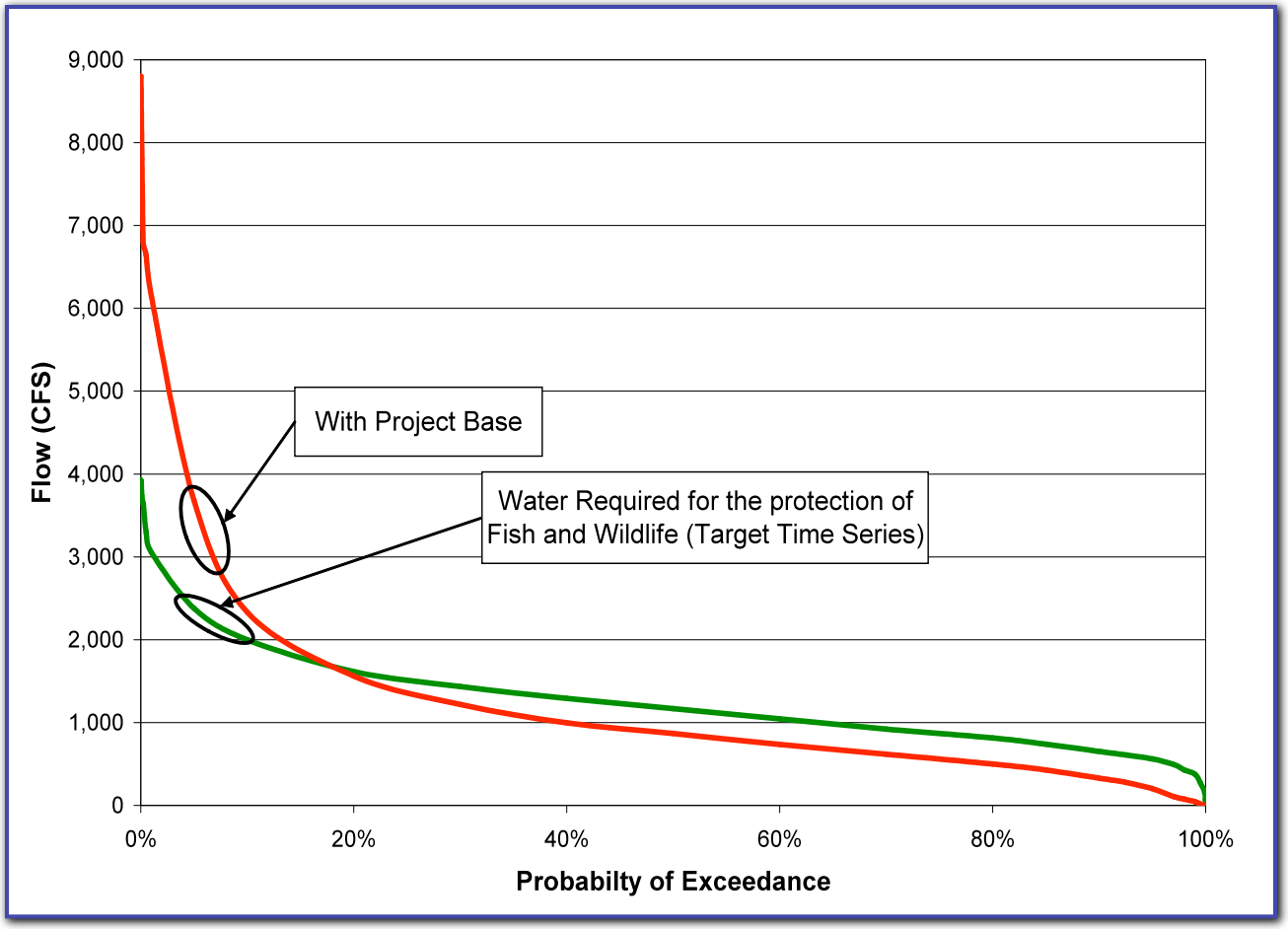
With Project Base Flow Probability Curve



Water Required for the Protection of Fish and Wildlife Probability Curve



Calculation of the Reservation Time Series



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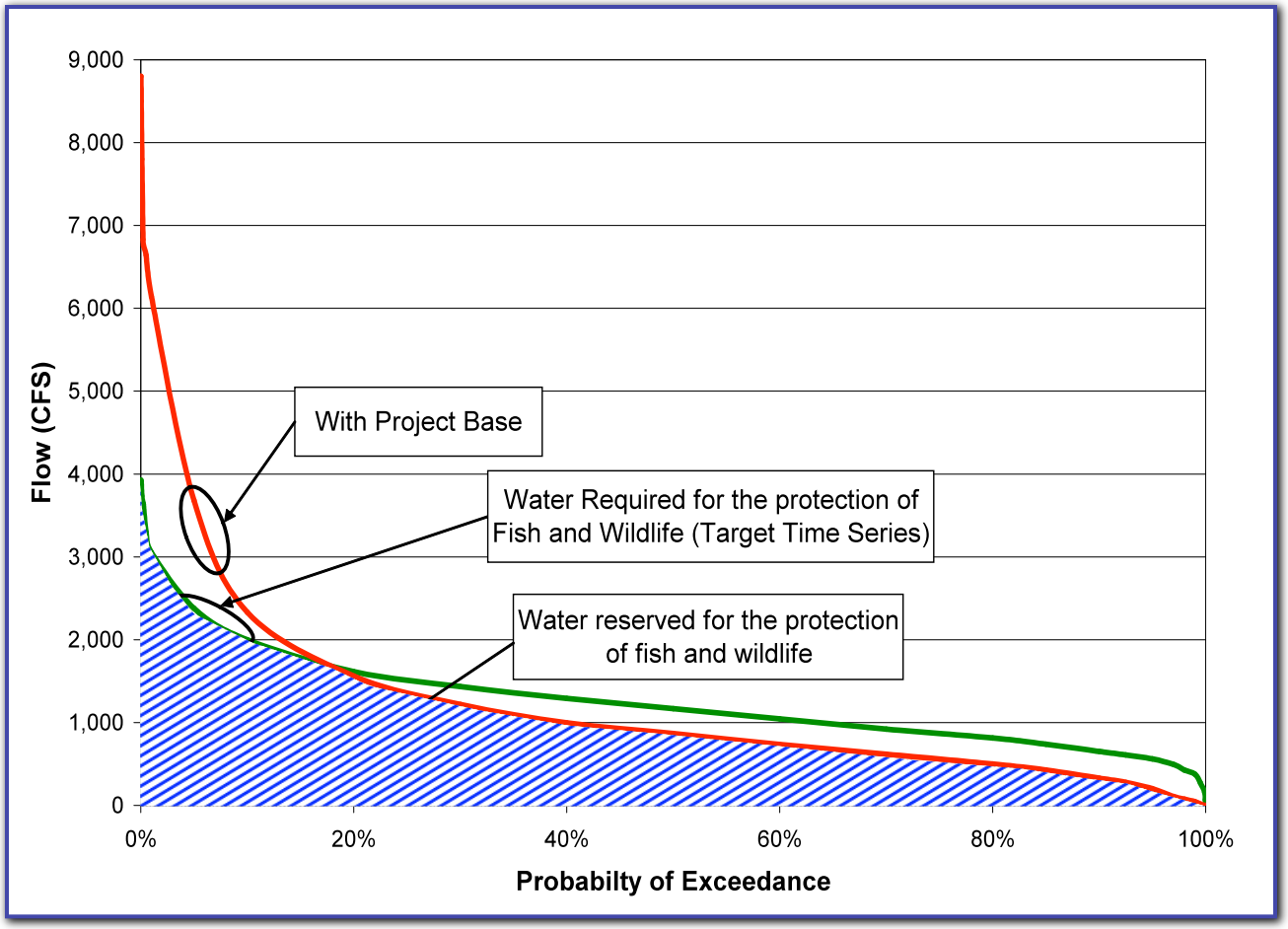

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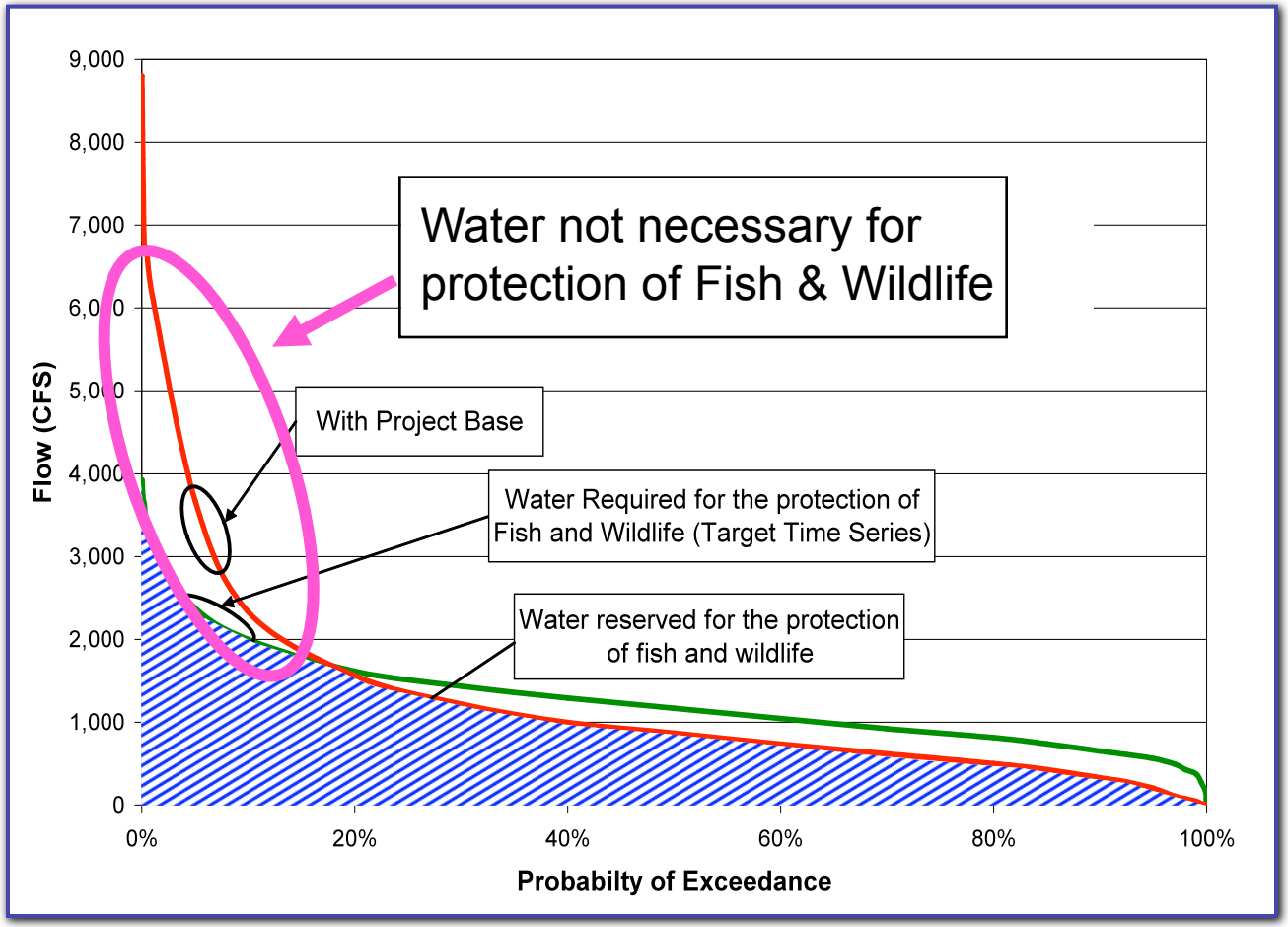
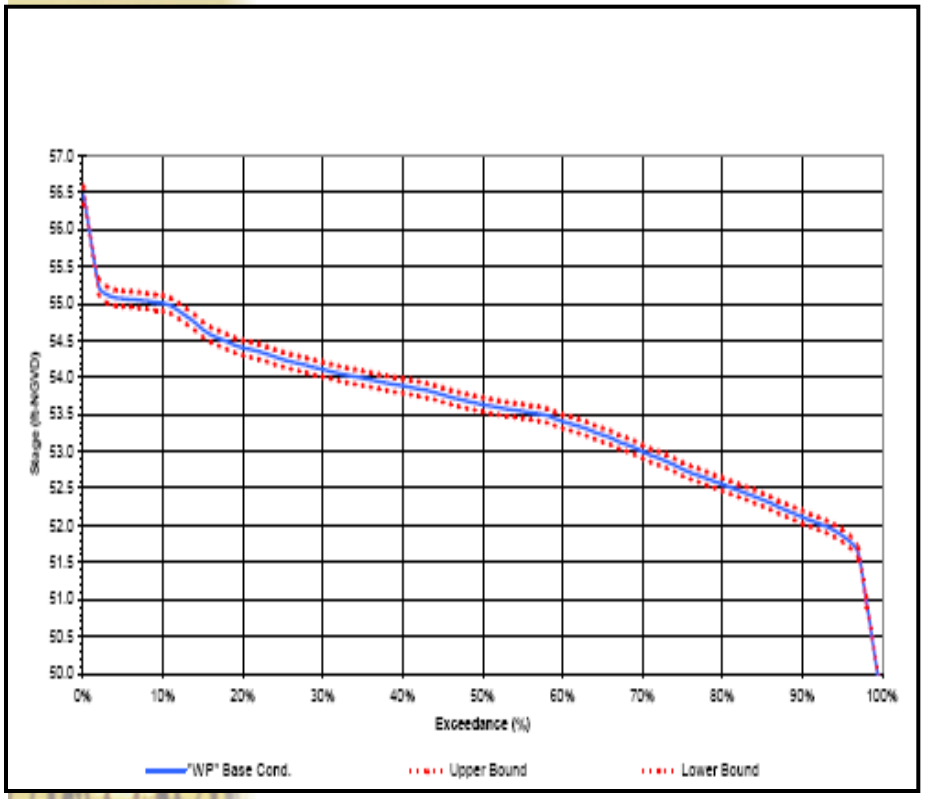
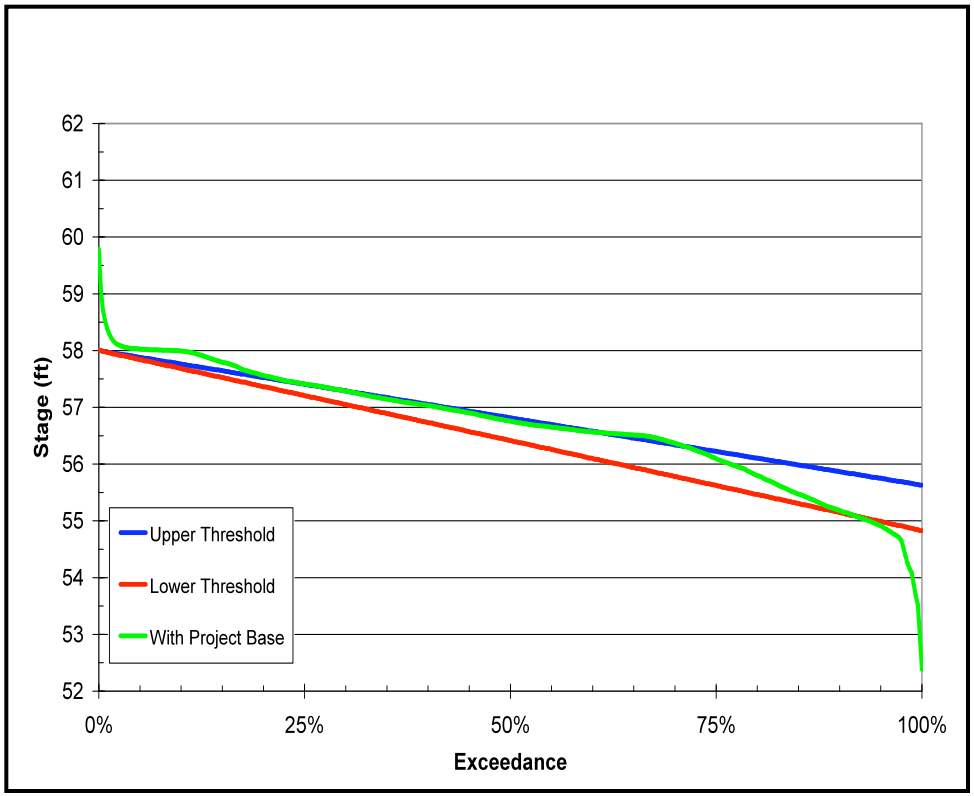


How sure we are with estimates?

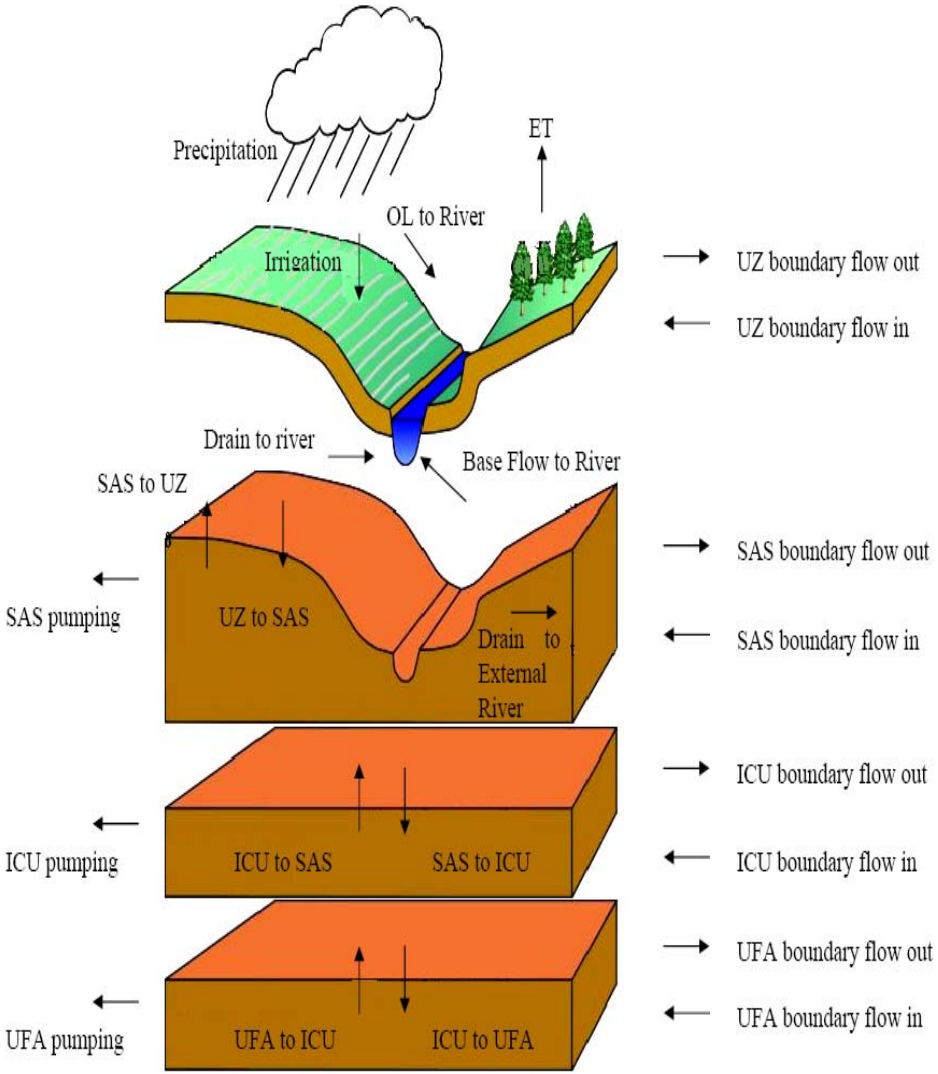
Model



Fish and wildlife requirements



Key Sources of Water



Contributing Source

- Surficial Aquifer
- Surface Water
  - 7 Lake Management Areas
  - Kissimmee River and floodplain
- Tributaries
  - Shingle, Boggy, and Reedy Creek
  - Chandler Slough

Non-contributing Source

- Floridan Aquifer

Next Steps

- Present policy issues to Governing Board – September 2009
- Draft Rule language for public coordination – September – December 2009


Thank You